PROJECT TITLE: Catastrophic flooding under climate change
DTP Research Theme(s): Changing Planet

Lead Institution: University of Bristol
Lead Supervisor: Professor Paul Bates CBE, University of Bristol, School of Geographical Sciences
Co-Supervisor: Dr. Gemma Coxon, University of Bristol, School of Geographical Sciences
Co-Supervisor: Dr. Ollie Wing, Fathom, Squareworks, 17 Berkeley Square, Bristol
Project Enquiries: paul.bates@bristol.ac.uk
Project keywords: Flooding, Climate Change, Catastrophe Modelling, Hydrology and Hydraulic Modelling

Fathom modelled flood extent and depths for the US Midwest floods in 2019 (right hand side) versus high resolution satellite imagery from Planet (left hand side, www.planet.com)

Project Background
Current society is already exposed to unacceptable levels of flood risk, and a changing climate, population growth and increases in vulnerability will likely mean even higher risk in the future. Every year, millions of people have their lives disrupted by floods and annual global economic losses can be >$100BN. Over the last five years we have developed methods to calculate current flood risk over whole continents or even the whole planet down to scales of a few 10s of metres, however projecting changing flood risk into the future is still an extreme challenge. This project will address this problem by producing the first catastrophe flood models for future conditions using a novel combination of state-of-the-art climate, hydrology and hydraulic modelling. The project will be run in collaboration with Fathom (www.fathom.global), a financial technology firm founded by members of the Hydrology Research Group at the University of Bristol to develop flood risk analytics for insurers, NGOs and humanitarian organisations.

Project Aims and Methods
The flood risk models used by the insurance industry are powerful tools for estimating current flood risk, but how these approaches can be used to examine future climate changes is currently unclear. Despite this, determining the impact of future flood risk on long term infrastructure decisions and financial investments relies on doing this well. This project will use new large climate model ensembles to develop multiple plausible realisations of future rainfall to drive multiple catchment hydrology and flood inundation models to produce property level predictions of current and future flood risk across whole countries (principally the UK and the US). We will examine how the spatial signature of catastrophic flood events will change into the future, how the balance between rainfall and river flooding might change and how this may make particular places more or less risky. The work builds on recent work for the First Street Foundation in the US where we have modelled property level flood risk for every home in the US under past, current future conditions. These data have been made available to the general public via https://floodfactor.com and this project will contribute to the next generation of this powerful tool and its extension to other territories such as the UK and Canada.
Candidate requirements
You should have a background in geography, environmental science, meteorology, oceanography or earth science. Good quantitative and data analysis skills as well as an aptitude for computer programming (or an ability to acquire this) are highly desirable. Candidates will be working within a large and collaborative team, so good inter-personal and project management skills will also be very helpful. *We welcome and encourage student applications from under-represented groups. We value a diverse research environment.*

CASE partner:
The CASE partner for this project is Fathom ([www.fathom.global](http://www.fathom.global)) a Bristol based start-up which provides flood analytic information to insurers, NGOs, humanitarian and environmental organisations and the finance sector. Working with Fathom will give you the opportunity to develop industry connections, train in the latest applied methods and use their software and high-performance computing resources for your analyses. Fathom will also provide the successful candidate with an honorarium of £5000 per year in addition to the NERC stipend for the duration of the PhD.

Training
You will receive specialist training in state-of-the-art catastrophe risk modelling and high-performance computing methods. The candidate will be able to work at both the University and at Fathom. It is also envisaged that part of the PhD (typically 1-3 months) will be spent at an overseas institution to collaborate with leading international researchers.

Background reading and references

Useful links
[http://www.bristol.ac.uk/geography/courses/postgraduate/](http://www.bristol.ac.uk/geography/courses/postgraduate/)
[http://www.bristol.ac.uk/geography/people/paul-d-bates/](http://www.bristol.ac.uk/geography/people/paul-d-bates/)
[http://www.bristol.ac.uk/geography/people/gemma-r-coxon/](http://www.bristol.ac.uk/geography/people/gemma-r-coxon/)
[http://www.fathom.global/](http://www.fathom.global/)

NERC GW4+ DTP Website:
For more information about the NERC GW4+ Doctoral Training Partnership please visit [https://www.nercgw4plus.ac.uk](https://www.nercgw4plus.ac.uk).

Bristol NERC GW4+ DTP Prospectus:
[http://www.bristol.ac.uk/study/postgraduate/2021/doctoral/phd-great-western-four-dtp/](http://www.bristol.ac.uk/study/postgraduate/2021/doctoral/phd-great-western-four-dtp/)

How to apply to the University of Bristol:
[http://www.bristol.ac.uk/study/postgraduate/apply/](http://www.bristol.ac.uk/study/postgraduate/apply/)

The application deadline is Friday 8 January 2021 at 2359 GMT.
Interviews will take place during week commencing 8th February 2021.

General Enquiries:
Bristol NERC GW4+ DTP Administrator
Email: bristol-nercgw4plusdtp-admin@bristol.ac.uk